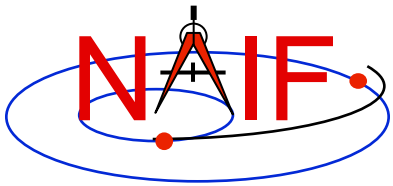


Navigation and Ancillary Information Facility

Obtaining SPICE Components Offered by NAIF and Horizons

Emphasis on Kernels

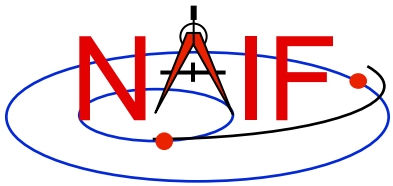
November 2014



Overview

Navigation and Ancillary Information Facility

- **Many SPICE products are available from the NAIF server**
 - These are mostly products produced at JPL by NAIF
 - Access is available using the http or ftp protocol
 - See the next page for URLs
- **SPICE products made by other organizations are controlled by those organizations**
 - Some may be available from the NAIF server
 - Some may be available at other public servers, or on restricted servers, or not at all
 - Unfortunately there is no simple rule set to describe what may be found where
 - As a general rule, NAIF has no cognizance of these products
- **Horizons is an on-line natural body ephemeris generator**
 - Use it to generate up-to-date SPKs for comets and asteroids



NAIF Server HTTP URLs

Navigation and Ancillary Information Facility

- **NAIF home page**

<http://naif.jpl.nasa.gov>

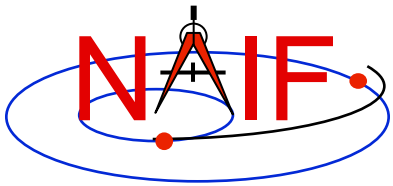
- Here you may access all official SPICE products produced by NAIF
 - kernels (generic, mission operations, and PDS archived ancillary data)
 - software (Toolkits and individual utility programs)
 - documents
 - tutorials
 - programming lessons
 - problem solving tips
 - rules about using SPICE
 - links to useful resources

- **SPICE announcements (by NAIF)**

https://naif.jpl.nasa.gov/mailman/listinfo/spice_announce

- **SPICE discussion (by anyone)**

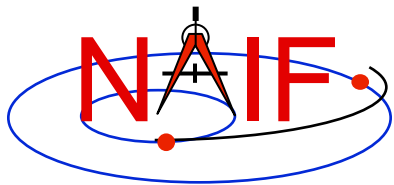
https://naif.jpl.nasa.gov/mailman/listinfo/spice_discussion



Getting SPICE Kernels

Navigation and Ancillary Information Facility

- **The remaining charts discuss where to find the various categories of SPICE kernel files**
 - **Operational flight project kernels**
 - » for (mostly JPL) active flight projects
 - **PDS archived kernels**
 - » those formally delivered to and accepted by NASA's Planetary Data System
 - **Generic kernels**
 - » used by many flight projects and other endeavors
 - » some of these are also available in the other two categories



Obtaining Operational Flight Project Kernels - 1

Navigation and Ancillary Information Facility

Open "http://naif.jpl.nasa.gov/naif/pds.html" in a new tab

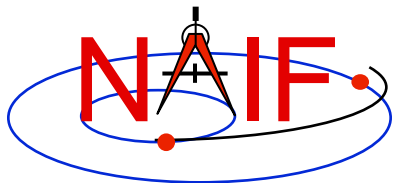
1 - Select the mission class of interest

2a - Select the project name to get access to the kernels folder for that project.
(see next page)

- or -

Mission	ck	ek	fk	ik	lsk	pck	sclk	spk
CASSINI*	5058*	473*	23*	13*	4*	352*	114*	4146*
GALILEO*	26	0		7	2	3	1	12*
JUNO*	222*		3*	11*	2*	3*	3*	178*
NEW HORIZONS*								1
PIONEER 10*								2*
PIONEER 11								9*
VOYAGER 1, 2*	10		2	4	0*	0*	2	

2b - Select the kernel type to get access to all kernels of that type for that project. The number tells how many kernels of that type are available.
(see next page)



Obtaining Operational Flight Project Kernels - 2

Navigation and Ancillary Information Facility

Access to kernels for the
named project

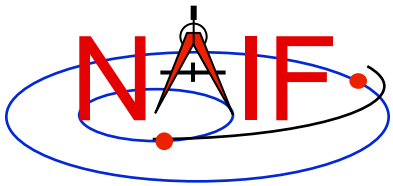
Access to kernels of
the selected type for
the named project

Index of /pub/naif/CASSINI/kernels

Name	Last modified	Size	Description
------	---------------	------	-------------

Parent Directory	-	-	-
aareadme.txt	11-Mar-2004 14:39	400	-
ck/	04-Mar-2013 09:58	-	-
ek/	05-Feb-2013 12:24	-	-
fk/	11-May-2009 12:04	-	-
ik/	07-Nov-2008 09:32	-	-
lsk/	10-Sep-2012 12:47	-	-
pck/	09-Jan-2013 21:03	-	-
sclk/	08-Feb-2013 18:47	-	-
spk/	05-Mar-2013 15:50	-	-

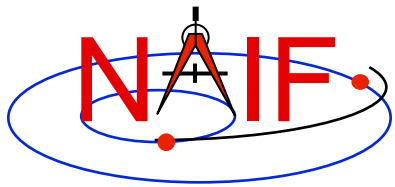
Index of /pub/naif/CASSINI/kernels/spk			
Name	Last modified	Size	Description
Parent Directory	-	-	-
000202R_SK_LP0_V1P32.bsp	21-Feb-2002 13:02	238K	SPK file
000202R_SK_LP0_V1P32.bsp.lbl	21-Feb-2002 13:02	2.3K	Detached file label (plain text)
000202R_SK_V1P32_V2P12.bsp	21-Feb-2002 13:02	502K	
000202R_SK_V1P32_V2P12.bsp.lbl	21-Feb-2002 13:02	2.6K	
000202R_SK_V2P12_EP15.bsp	21-Feb-2002 13:02	198K	
000202R_SK_V2P12_EP15.bsp.lbl	21-Feb-2002 13:02	2.5K	
000203_SE_JUP156.bsp	21-Feb-2002 13:03	4.9M	
000203_SE_JUP156.bsp.lbl	21-Feb-2002 13:03	3.2K	
000331RB_SK_V1P32_V2P12.bsp	16-Jun-2005 13:02	623K	
000331RB_SK_V1P32_V2P12.bsp.lbl	16-Jun-2005 13:02	5.2K	
000331R_SK_LP0_V1P32.bsp	21-Feb-2002 13:03	307K	
000331R_SK_LP0_V1P32.bsp.lbl	21-Feb-2002 13:03	3.9K	
000331R_SK_V1P32_V2P12.bsp	21-Feb-2002 13:03	622K	
000331R_SK_V1P32_V2P12.bsp.lbl	21-Feb-2002 13:03	3.9K	
...	21-Feb-2002 13:03	218K	
...	21-Feb-2002 13:03	3.6K	
aareadme.txt			Description of file naming scheme



Obtaining PDS Archived Kernels

Navigation and Ancillary Information Facility

- **The best method for obtaining PDS archived kernels is directly from the NAIF server.**
 - Complete SPICE data sets exist on the NAIF server fully expanded—not bundled in a Zip or tar file
 - Unless you have reason to do otherwise, download the entire archival data set using the ftp URL
 - » That way you'll get all the latest data, the associated “furnsh kernels”, and the best documentation.
 - If the data set is large and you need only a portion of it based on start/stop time, use the “subsetter” link to obtain the smaller amount of data needed.
- **A pictorial example is shown on the next page**



Obtaining Archived Kernels from the NAIF Server - 1

Navigation and Ancillary Information Facility

Mission Name	Archive Overview	Volume FTP Link	Data Size (gbytes)	Start Time	Stop Time	Data Set Subsetter Link
Cassini Orbiter	aareadme.htm	cosp_1000	18.6	1996-11-06	2008-12-31	subset
Clementine	aareadme.htm	clsp_1000	0.8	1994-01-26	1994-05-07	subset
Deep Impact	aareadme.htm	disp_1000	0.5	2005-01-12	2009-01-15	subset
Deep Space 1	aareadme.htm	ds1sp_1000	0.9	1998-10-24	2003-12-31	subset
MER 1 (Opportunity)	aareadme.htm	mer1sp_1000	1.8	2003-07-07	2009-05-19	subset
MER 2 (Spirit)	aareadme.htm	mer2sp_1000	1.5	2003-06-10	2009-04-28	subset
MESSENGER	aareadme.htm	messsp_1000	12.7	2004-08-03	2008-10-20	subset
Mars Express	AAREADME.TXT	mexsp_1000	0.9	2003-06-02	2008-07-31	subset
Mars Global Surveyor	aareadme.htm	mgsp_1000	15.4	1996-11-06	2006-11-02	subset
Mars Odyssey	aareadme.htm	odsp_1000	9.0	2001-04-07	2009-03-31	subset

Index of ftp://naif.jpl.nasa.gov/pub/naif/pds/data/co-s_j_e_v-spice-6-v1.0/cosp_1000/

[Up to higher level directory](#)

Name

- [aareadme.htm](#)
- [aareadme.lbl](#)
- [aareadme.txt](#)
- [catalog](#)
- [data](#)
- [document](#)
- [errata.txt](#)
- [extras](#)
- [index](#)
- [software](#)
- [volDESC.cat](#)

If you select “PDS Archive Area” on the NAIF web page you can follow a path like this one.

- You can use the ftp URL along with Unix “wget” or the FileZilla tool, or some other equivalent, to download the entire data set—**recommended, if not too large! Otherwise see the next page.**

- Or you can select specific kernels from the kernel folders, and/or “furnsh” meta- kernels and other items from the extras folder

[Up to higher level directory](#)

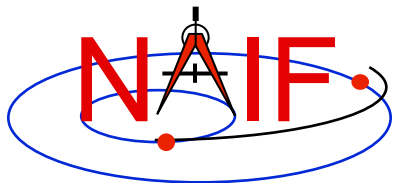
Name

- [ck](#)
- [ek](#)
- [fk](#)
- [ik](#)
- [lsk](#)
- [pck](#)
- [sclk](#)
- [spk](#)

[Up to higher level directory](#)

Name

- [ckextra](#)
- [extrinfo.txt](#)
- [mk](#)
- [orbnum](#)



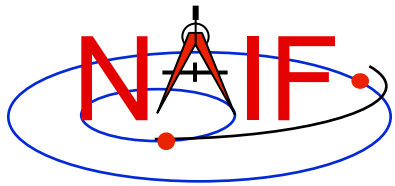
Obtaining Archived Kernels from the NAIF Server - 2

Navigation and Ancillary Information Facility

Mission Name	Archive Overview	Volume FTP Link	Data Size (gbytes)	Start Time	Stop Time	Data Set Subsetter Link
Cassini Orbiter	aareadme.htm	cosp_1000	18.6	1996-11-06	2008-12-31	subset
Clementine	aareadme.htm	clsp_1000	0.8	1994-01-26	1994-05-07	subset
Deep Impact	aareadme.htm	disp_1000	0.5	2005-01-12	2009-01-15	subset
Deep Space 1	aareadme.htm	ds1sp_1000	0.9	1998-10-24	2003-12-31	subset
MER 1 (Opportunity)	aareadme.htm	mer1sp_1000	1.8	2003-07-07	2009-05-19	subset
MER 2 (Spirit)	aareadme.htm	mer2sp_1000	1.5	2003-06-10	2009-04-28	subset
MESSENGER	aareadme.htm	messsp_1000	12.7	2004-08-03	2008-10-20	subset
Mars Express	AAREADME.TXT	mexsp_1000	0.9	2003-06-02	2008-07-31	subset
Mars Global Surveyor	aareadme.htm	mgsp_1000	15.4	1996-11-06	2006-11-02	subset
Mars Odyssey	aareadme.htm	odsp_1000	9.0	2001-04-07	2009-03-31	subset

For “large” data sets that might take a long time to download, if you really need just a subset of the data covering a limited amount of time you should use the “Subset Link” for the data set of interest.

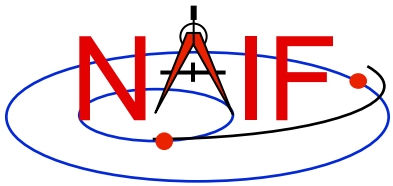
This process will automatically select just the kernels that fall within or overlap the time bounds you specify, construct a new “FURNISH” kernel(s) containing the names of this subset of kernels (thus making it easy for you to load the subset into your program), and create a custom wget script you may use to download these files to your computer.



Downloading Archived Kernels from the NAIF Server

Navigation and Ancillary Information Facility

- **Use GNU's wget or FileZilla or a similar utility to download the complete SPICE data set**
 - Possible wget usage, and an example using Deep Impact
 - » **wget -m -nH --cut-dirs=5 -nv (insert the URL of the "Volume FTP Link" for the SPICE data set here). For example:**
 - `wget -m -nH --cut-dirs=5 -nv ftp://naif.jpl.nasa.gov/pub/naif/pds/data/di-c-spice-6-v1.0/disp_1000/`
 - **FileZilla info**
 - » **http://filezilla-project.org/client_features.php**



Horizons

Navigation and Ancillary Information Facility

- **Horizons is an on-line ephemeris generator for natural bodies (and more)**
 - Operated by JPL's Solar System Dynamics Group
- **Of primary interest to SPICE users is its ability to generate up-to-date SPK files for comets and asteroids**
 - Horizons home:
 - » <http://ssd.jpl.nasa.gov/?horizons>
 - Horizons web interface for manual generation of small body SPKs:
 - » <http://ssd.jpl.nasa.gov/x/spk.html>
 - Horizons telnet interface for automated (programmatic) generation of small body SPKs:
 - » `telnet ssd.jpl.nasa.gov 6775`
 - » For example script look at:
 - ftp://ssd.jpl.nasa.gov/pub/ssd/smb_spk